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HISTORY OF THE MK 12 WEAPON (U)

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5/13/53	Division of Military Application cancels the TX-12 and requests concentration of effort on TX-12-X1 hard case design.
3/31/54	TX-12-X1 design discussed in meeting of Special Weapons Development Board and accepted.
5/1/54	Mk 12 Mod 0 design released.
12/54	Mk 12 Mod 0 Bomb enters stockpile.

Mk 12 Warhead

2/1/51	Military Liaison Committee notifies the Division of Military Application that the Air Force is contracting for Bureau of Ordnance development of an air-launched, free-flight rocket.
4/10/51	(b)(3)
6/5/51	Santa Fe Operations Office assigns nomenclature of XW-12.
7/13/51	TX-N Committee urges that XW-12 Warhead be assigned a high development priority.
10/29/52	Military Liaison Committee requests the Division of Military Application to undertake a preliminary investigation of an air-defense warhead.
11/14/52	Division of Military Application suggests that the study of an air-defense warhead include application to TALOS missile.
2/10/53	Military Liaison Committee notes that the Joint Chiefs of Staff have established a requirement for development of surface-to-air missiles with atomic warheads, with particular reference to the TALOS missile.
5/15/53	Field Command proposes set of military characterisitcs for a 22-inch-diameter air-defense warhead.

6/23/53	Bureau of Ordnance notes that XW-12/TALOS-W warhead installation cannot meet all the requirements for the air-defense warhead.
10/6/53	Armed Forces Special Weapons Project requests that XW-12 Warhead use as many Mk 12 Bomb components as possible, in order to expedite the development work.
1/18/54	Field Command requests Sandia to continue study of warheads capable of operation at high altitudes.
10/11/54	Field Command requests Sandia to delay Joint Task Group activities on the XW-12/TALOS-W, due to unavailability of missiles.
12/14/54	Proposal made that the XW-30 Warhead replace the XW-12.
11/21/55	XW-12/TALOS-W project terminated in favor of use of XW-30 Warhead.

History of the Mk 12 Weapon

Mk 12 Bomb

One of the military aims in the early development of atomic weapons was that of reducing the size and weight of the implosion bomb. Much progress had been made toward this end in the Mk 5 and Mk 7 programs, and, subsequently, the Los Alamos Scientific Laboratory continued intensive study in this area.

(b)(3)

This request was accordingly integrated into the 1951 Los Alamos program.[2]

(b)(3)

The desired military characteristics were forwarded by the Military Liaison Committee to the Division of Military Application March 6, 1951.[4] These called for an implosion weapon smaller than the TX-7 and established a maximum weight of 1200 pounds for the bomb. It was requested that the

Sandia presented a draft report of the proposed ordnance characteristics of the TX-12 to the October 12, 1951 meeting of the Sandia Weapons Development Board. The box dimensions of the tail fins had been established at 30 inches. A duplicate set of batteries would be incorporated to increase weapon reliability.

(b)(1), (b)(3)

The subject was discussed in the November 7 and December 11, 1951, meetings of the Sandia Weapons Development Board.[17,18] It was felt essential to

have complete flexibility of action, and a decision was made to provide a 7-option fuze, to include:

Radar air burst 1 with safe-separation time 1
Radar air burst 2 with safe-separation time 2
Radar air burst 1 with safe-separation time 2
Radar air burst 2 with safe-separation time 1
Timer air burst 1 with safe-separation time 3
Timer air burst 2 with safe-separation time 4
Contact burst with safe-separation time 5.[19]

Subsequently, Sandia made a survey of weapons then being designed, and proposed use of a tactical fuze on the Mk 7 and Mk 12 Bombs. This proposal would have standardized fuze design and simplified pilot operation, but a decision was made that flexibility was preferred.

The initial provisions for bomb carriage included a Navy wing rack with a separation of 14 inches between attachment lugs and an Air Force rack with 30 inches between lugs. In late 1951 the Navy changed the 14-inch rack to a 20-inch design. It was subsequently suggested that the mid portion of the bomb case be strengthened so that sway bracing would not damage the case. Initially, it was requested that work continue on the original case design, and that the strong case be provided in a modification, and this proposal was accepted by the Military Liaison Committee July 9, 1952.[20]

The barometric switches were deleted in early 1952.[21] A decision had been made to use the TX-12 only as a tactical bomb and in low-altitude releases.[22] The baroswitches were then unnecessary, as they were designed to prohibit arming of the X-unit at high altitudes and prevent inadvertent arcing. Additionally, low-pressure testing of X-units had demonstrated that there was little possibility of such arcing at altitudes up to 50,000 feet.

modification program, called the TX-12-X2, was instituted to provide a more rugged fin, a more powerful operating motor, and a gear train to carry heavier loads.[34] This modification was scheduled to appear in stockpile during December 1956, but difficulties with the fin actuation mechanism delayed production of acceptable Mod kits of the Mk 12 Mod 1 until February 1957. The stockpile was completely modified by November 1957, with the allowable fin operating speed being increased to 220 knots. Simultaneously, a set of canted lugs was provided, to provide better compatibility with AD-series aircraft.[35]

Mk 12 Warhead

The Military Liaison Committee notified the Division of Military Application February 1, 1951, that the Air Force was contracting for Navy Bureau of Ordnance development of an air-launched, free-flight rocket.

(b)(3)

This information was forwarded to Santa Fe operations Office with a request that some thought be given to this usage, but that work on the TX-12 Bomb not be delayed.[37]

Additional criteria covering this rocket-warhead combination were furnished by the Division of Military Application March 13, 1951. Possible uses of the weapon included support of troops and defense against mass aircraft raids. Since it was desirable to carry the weapon on small, fast aircraft, its size and weight were to be as small as possible, and it was hoped that the weapon shape would have minimum effect on aircraft performance. The range of the rocket would enable safe escape of aircraft and crew after weapon launch.

(b)(1), (b)(3)

It was noted that a time fuze might be best for certain targets, but that requirements for accuracy of burst height in low-altitude deliveries might well require a target-triggered system.[38]

(b)(3)

Subsequently, November 16, 1951, the Committee on Atomic Energy of the Research and Development Board (the postwar replacement of the Office of Scientific Research and Development) noted that the ability to transport and direct atomic warheads against military targets constituted a most serious problem. The Committee noted that, with development of smaller and lighter atomic warheads, delivery would no longer be restricted to large bombers, and that guided missiles and rockets would be available in the near future. The report urged that high priority be given to the development of an air-to-ground rocket with an air-burst atomic warhead, to be used by attack and fighter aircraft making target approaches at low altitudes.[41]

The Military Liaison Committee notified the Division of Military Application February 10, 1953, that the Joint Chiefs of Staff had established a formal requirement for development of surface-to-air missiles with atomic warheads. The immediate objective was the design of an air-defense system to deliver an XW-12 Warhead by means of the TALOS-W missile.[47] The TALOS was 30 inches in diameter and 30 feet long, and was in the shape of a cylinder with one set of four stubby fins at its midpoint and another set at its tail. The missile was fired vertically, then programmed over into horizontal flight at a speed of Mach 2 to its target, which could be 60 miles distant. The Atomic Energy Commission would provide the warhead, and the Bureau of Ordnance would have responsibility for the rest of the weapon, with the Johns Hopkins Applied Physics Laboratory acting as prime contractor for the Navy.

It was planned to carry engineering studies through detail design and fabrication of a limited number of nose sections, complete with simulated warheads or warhead components. These nose sections would be combined with tail sections and subjected to flight tests, starting December 1953, as the final step in establishing the feasibility of the missile as an atomic warhead carrier. A TALOS-W Coordination Committee was appointed and held its first meeting March 4, 1953,[48] and the program was placed in design development stage March 6, 1953.

The Coordination Committee met April 10, 1953. Sandia discussed safing and arming problems, and proposed that 5000 feet be established as an adequate safe-separation distance and that, for failures just off the launcher, there be no self-destruct provisions. Likewise, in the late boost phase and in the time interval between separation and the end-of-being captured phase, there should be no self-destruct provisions, as nuclear arming would not have been initiated by this time. For subsequent failures it was recommended that self-destruction be required. The Atomic

Energy Commission would supply the warhead, with all necessary testing and handling equipment, and the Navy would be responsible for the adaption kit, including the warhead primary power supply.[49]

Field Command proposed, May 15, 1953, a set of military characteristics for an air-defense warhead having an outer diameter of 22 inches.

(b)(1), (b)(3)

Due to a possible requirement for high quantities, it was requested that the warhead have minimum nuclear and monetary cost.

A maximum weight of 650 pounds and a length of 60 inches was desired. The warhead would have to withstand accelerations of ±50 g's along the longitudinal axis of the warhead and 10 g's along any axis perpendicular to this. Other environmental conditions included temperatures from -65°F to +165°F and altitudes from sea level to 80,000 feet. Nuclear insertion should be possible at any time during warhead flight except during high acceleration and boost. Operating cycles should not exceed 6 seconds for insertion, nor 3 seconds for retraction. The warhead, except for the nuclear capsule, should remain functionally ready for periods of at least 6 months when installed in the missile. The nuclear capsule should be capable of storage in the insertion mechanism for at least 30 days.[50]

The Bureau of Ordnance notified Field Command June 23, 1953 that the XW-12/TALOS-W warhead installation could meet some, but not all, of the above requirements for an air-defense warhead. It was pointed out that the proposal to the Joint Chiefs of Staff had been based on use of TX-12 Bomb components in the XW-12 Warhead. This did not provide an optimum weapon, but the decision appeared both practical and in the best interests of the Services. The Bureau noted that early flights of the TALOS-W program were scheduled for December 1953, that airframe hardware had been released for production, and that the first missile was being assembled. It was felt that the nuclear capsule could not resist a 30-day storage period in an uncontrolled atmosphere.[51]

At the meeting of the TALOS-W Coordination Committee on June 25, 1953, Sandia stated that delivery of production-type warheads to stockpile could be made by June 1955, provided that the approved military characteristics were similar to those proposed by Field Command and that an early resolution of the self-destruction problem could be achieved. Development of a new and smaller X-unit, which had been under way at Sandia since January, was given Committee support. Production of the TALOS-W by the Navy was promised for early 1955.[52]

The August 4, 1953 meeting of the Coordination Committee heard a Sandia report on the self-destruction mechanism. This report proposed rapid retraction of the nuclear capsule, achieved by applying a higher voltage than normal to the mechanism. This, combined with a modification to the retraction gear ratio, promised a faster retraction time than previously believed possible. The Committee approved the proposal and requested that Sandia provide a detailed design.[53]

The Armed Forces Special Weapons Project in Washington notified Field command, October 6, 1953, that the XW-12 Warhead should use as many components from the TX-12 Bomb as possible, in order to accelerate development of the warhead. It was recognized that the XW-12/TALOS was not an optimum warhead for air-defense use, as it made uneconomical use of fissionable material, could not operate at high altitudes without an artificial environment, and could not withstand long storage in the operationally ready condition (that is, with the nuclear components installed in the nuclear insertion mechanism), without an artificial environment. However, no changes which would delay development would be allowed unless these were required to ensure proper operation. It was hoped that the weapon would provide an interim capability with at least some of the desired characteristics. Complete design release of the warhead installation was scheduled for the second quarter of 1954, first production by the second quarter of 1955, and stockpile entry in the third quarter of 1955.[54]

Meanwhile, the Bureau of Ordnance had noted that the design of the missile/warhead had progressed to the point where it was necessary to provide a definite division of responsibilities in the development of the warhead adaption kit. The TALOS-W warhead was contained in an isolated inner body which held only the warhead and some adaption-kit components, all of which performed functions relating to warhead operations. It was thus felt that the Atomic Energy Commission should assume development responsibility for these components in order to assure proper warhead functioning, and the AEC was requested to take over cognizance of the safing and arming system, the self-destruction system, plus hardware and adapters.[55]

The Santa Fe Operations Office replied that prime responsibility for design and development of the TALOS-W adaption kit rested with the Bureau of Ordnance, and that there was no compelling reason to reassign any of the portions of the adaption kit. However, the AEC, in a subcontractorlike role, could undertake to design and develop any portions of the kit for the Bureau of Ordnance on a reimbursable basis.[56] This information was forwarded to the Navy Department by the Division of Military Application.[57]

Field Command wrote to AEC-Sandia January 18, 1954, noting that the use of an artificial environment, to ensure warhead operability at all TALOS-W flight altitudes, would be acceptable in order to expedite design release of the warhead installation. However, it was requested that Sandia continue work on a warhead capable of operation at altitudes up to 60,000 feet without an artificial environment in the TALOS-W, and up to 100,000 feet in other applications. Hopefully, components so developed could be used in any air-defense warhead.

Sandia replied, February 2, 1954, that the warhead was located in the duct of the missile's ram-jet engine, where the pressure was greater than in other locations. This, of course, did not exactly provide an artificial

malfunction on another. All warhead components had been design-released, and drawings and specifications had been completed and filed for possible future reference.[64]

On November 21, 1955, the Assistant Secretary of Defense officially terminated the XW-12/TALOS-W project.

Glossary of Mk 12 Terms

Abee -- A radar design that superseded the Archie, a development of the "Tail-Warning Charlie" radar that signaled the approach of an enemy aircraft.

Adaption Kit -- Those items peculiar to the warhead installation less the warhead; namely, the arming and fuzing systems, power supply, and all hardware, adapters, and the like, required by a particular installation.

AEC-Sandia -- The Sandia Field Office of the Atomic Energy Commission.

Albert -- A radar design that superseded the Abee.

Armed Forces Special Weapons Project -- An interdepartmental agency formed to handle military functions related to atomic weapons.

Assistant Secretary of Defense -- Created by Department of Defense directive June 30, 1953, as part of DOD reorganization. Handles research and development activities of the DOD.

Barometric Switch -- A switch actuated by air pressure.

Bureau of Ordnance -- That part of the Navy Department having to do with design and procurement of ordnance.

Capsule -- The nuclear ~~assembly~~ element of an atomic weapon which, when subjected to compression in the implosion process, becomes supercritical and produces a nuclear reaction.

Centrifuge -- A device employing centrifugal force to stress weapons components. Consists of a horizontally mounted arm. On one end of the arm is placed the item to be tested; on the other end of the arm is placed a rocket engine. Firing of the rocket causes a high rotational speed of the arm.

Contact Fuze -- A fuze that detonates the weapon by contact with the ground or the target.

Detonators -- ~~Devices containing bridge wires which, when subjected to an electrical current, burn rapidly and act as a match to apply a flame to various points on the outer surface of the high-explosive sphere.~~ Explosive devices which when initiated by the X-unit signal the lens charges of the high explosive sphere.

Division of Military Application -- An AEC office that functions as liaison between the Military and the weapons designers and producers.

Field Command -- The local office of the Armed Forces Special Weapons Project, located on Sandia Base, New Mexico.

Fuze -- A combination of the arming and firing devices of a weapon.

Guided Missile -- A trajectile that is directed to its target while in flight or motion, either by a preset self-reacting device within the trajectile or by radio command outside the missile.

Implosion -- The effect created when a sphere of high explosive is detonated on its exterior surface. The force of the shock wave is directed largely toward the center of the sphere.

Inverter -- A device for converting direct current into alternating current.

Joint Chiefs of Staff -- An Army-Navy-Air Force group to determine policy and to develop joint strategic objectives of the Armed Forces.

Joint Task Group -- A military group established to test the stockpile-to-target sequence of a weapon.

Kiloton -- A means of measuring the yield of an atomic device by comparing its output with the effect of an explosion of TNT. A 1-kiloton yield is equivalent to the detonation effect of 1000 tons of high explosive.

Mach -- A measure of speed. Mach 1.0 is the speed of sound, or 738 miles per hour at sea level.

Military Characteristics -- The attributes of a weapon that are desired by the Military.

Military Liaison Committee -- A Department of Defense committee established by the Atomic Energy Act to advise and consult with the Atomic Energy Commission on all matters relating to military applications of atomic energy.

Missile Warhead -- The explosive or nuclear device carried by a missile.

Operation Tumbler-Snapper -- See Tumbler-Snapper.

(b)(3)

59. SRD Ltr, Field Command to Sandia Corporation, dtd 10/11/54, subject, Joint Task Group, XW-12/TALOS-W. AEC Files, MRA-5, XW-12/TALOS Program Correspondence.

60. SRD Minutes, TALOS-W Coordination Committee to Distribution, dtd 12/14/54, subject, Minutes of 8th Meeting. AEC Files, MRA-5, XW-12/ TALOS Program Correspondence.

61. SRD Minutes, RS 3466/84055, Special Weapons Development Board to Distribution, dtd 1/12/55, subject, Minutes of the 89th Meeting, Part I. SC Archives, Transfer No. 48217.

62. SRD Ltr, Sandia Corporation to Santa Fe Operations Office, dtd 2/10/55, subject, XW-12/TALOS-W Program. AEC Files, MRA-5, XW-12/TALOS Program Correspondence.

63. SRD Ltr, Military Liaison Committee to U. S. Atomic Energy Commission, dtd 6/21/55, subject, Warhead for TALOS-W Missile. AEC Files, MRA-5, XW-30, 7/55.

64. SRD Minutes, RS 3466/84443, Special Weapons Development Board to Distribution, dtd 4/27/55, subject, Minutes of 92nd Meeting, Part I. SC Archives, Transfer No. 48217.

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